30. The laser apparatus of claim 28, further comprising dither means for introducing a frequency modulation to said loss element.

REMARKS

This Amendment is in response to the Office Action dated October 23, 2002. In the Office Action, the Examiner rejected claims 1-20, 21, 22, 24, 26 and 28 under 35 U.S.C. § 103(a) as being unpatentable over Shimada et al., U.S. patent No. 4,460,977 (hereinafter *Shimada*) in view of Asano et al., U.S. Patent No. 6,044,095 (hereinafter *Asano*). Claims 23, 25, 27 and 30 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Shimada* in view of *Asano*, further in view of Van Dijk, U.S. Patent No. 4,847,854 (hereinafter *Van Dijk*). Claim 21 was also rejected for statutory type (35 U.S.C. § 101) double patenting.

Claim 21 is amended as shown above, to more clearly recite features of the claimed invention, and to overcome the statutory type double patenting rejection. Claim 30 has been amended to correct reference to the base claim from which it was to depend. The specification has been amended to fill in the Application Serial Nos. missing from the original application. Claim 22 is canceled herein without prejudice. Claims 1-21, and 23-30 are now pending in the application. For the reasons set forth below, the Applicants respectfully request reconsideration and allowance of all pending claims.

CLAIM REJECTIONS - 35 U.S.C. § 103

To establish a *prima facie* case of obviousness, there must first be some suggestion or motivation to modify a reference or to combine references, and second be a reasonable expectation of success. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in

the prior art and not based on applicant's disclosure. Third, the prior art reference (or references when combined) must teach or suggest all the claim limitations. M.P.E.P. § 706.02(j) from *In Re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). Where claimed subject matter has been rejected as obvious in view of a combination of prior art references, a proper analysis under § 103 requires, *inter alia*, consideration of two factors: (1) whether the prior art would have suggested to those of ordinary skill in the art that they should make the claimed device; and (2) whether the prior art would also have revealed that in so making, those of ordinary skill would have a reasonable expectation of success. Both the suggestion and the reasonable expectation of success must be founded in the prior art, not in the Applicants' disclosure. *Amgen v. Chugai Pharmaceutical*, 927 F.2d 1200, 18 USPQ2d 1016 (Fed. Cir. 1991), *Fritsch v. Lin*, 21 USPQ2d 1731 (Bd. Pat. App. & Int'f 1991). An invention is non-obvious if the references fail not only to expressly disclose the claimed invention as a whole, but also to suggest to one of ordinary skill in the art modifications needed to meet all the claim limitations. *Litton Industrial Products, Inc. v. Solid State Systems Corp.*, 755 F.2d 158, 164, 225 USPQ 34, 38 (Fed. Cir. 1985).

The examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references. M.P.E.P. § 70602(j) from *Ex parte Clapp*, 227 USPQ 972, 973 (Bd. Pat. App. & Inter. 1985). Obviousness cannot be established by combining references without also providing evidence of the motivating force which would impel one skilled in the art to <u>do what the patent applicant has done</u>. M.P.E.P. § 2144 from *Ex parte Levengood*, 28 USPQ2d 1300, 1302 (Bd. Pat. App. & Inter. 1993) (emphasis added by M.P.E.P.).

<u>Traversal of the Rejection of Claim 1 and Claims Dependent Thereon</u>

With respect to claims 1-20, the Examiner states, "the methods for operating a laser are considered product by process steps." Applicants respectfully assert that

claims 1-20 are not product by process steps, but pertain to methods for operating a laser. For example, claim 1 recites:

1. A method for operating a laser with a semiconductor gain region, comprising monitoring voltage across said gain region, and *determining cavity losses according to said monitored voltage across said gain region*. (Emphasis added)

This claim is roughly analogous to the operation of the apparatus of claim 21, as originally filed. In support of the rejection of claim 21, the Examiner asserts that *Shimada* discloses a laser apparatus comprising all of the structural elements of the claimed apparatus, except for a voltage sensor. The Examiner then asserts that *Asano* discloses "a voltage sensor operatively coupled to said gain medium (11) and configured to monitor voltage across said gain medium, said monitored voltage across said gain medium indicative of optical losses associated with said cavity."

Shimada discloses an optical memory playback apparatus, that is directed towards reading optically-encoded disks, such as audio disks, video disks, and data-storage optical disks. As shown in Figure 6, the *Shimada* apparatus includes a semiconductor laser element 1, lenses 2 and 3, an optical sensor 4, all disposed in a housing 5. A sensor terminal 6 is coupled to the semiconductor laser element 1 via a capacitor 10. These elements are common to a prior art optical memory playback apparatus. *Shimada* further includes a spatially uneven phase plate 11, which is disposed between lenses 2 and 3.

The *Shimada* apparatus operates in a manner similar to the prior art apparatus of Figure 1, except for the inclusion of the spatially uneven phase plate 11, which creates a multimode laser signal from a single-mode laser beam. This enables a single-mode laser to be used for the semiconductor laser element, which provides an asserted improvement over the prior art apparatus.

The apparatus of Figure 6 operates in the following manner. In response to a current supplied by a power source 8, the semiconductor laser emits a laser beam from

its output side, which is converged by lens 2 and then passes through the spatially uneven phase plate 11. Uneven phase plate shifts the phase of various portions of the laser beam that pass through it, to produce a multimode laser beam. The multimode laser beam then passes through lens 3, which focuses the beam such that it is reflected off of a recording medium 7, which contains data encoded thereon. The data are encoded via either a plurality of "pits" (similar to that employed by a CR-ROM, DVD, etc.), encoded means for varying the intensity of the reflected laser beam (for optical disc memory), or change in the plane of polarization (for magnetic optical disk), each of which is used for digitally encoding data content (see col. 6, lines 42-57, generally). The laser beam is reflected off of the recording medium and returned through the same optical elements (lens 2, 3 and spatially uneven phase plate 11) and fed back to the semiconductor laser element 1. Consequently, "the return laser beam fed back from medium 7 induces a self-coupling effect and causes variation in the optical output of the laser element and in the terminal voltage at the sensor terminal 6" (Col. 3, lines 4-9). With respect to the pitted recording medium, this variation is caused by the change in the length of the optical path between the semiconductor laser element 1 and the recording medium 7 in the pitted and non-pitted areas on the disk. In other words, as pitted and non-pitted areas on the disk are encountered, the self-coupling effect causes a corresponding change in the terminal voltage detected at the sensor terminal 6, which enables data stored on recording medium 7 to be read, as disclosed, in part, in Col. 3, lines 23-26.

Asano discloses a light emitting device drive circuit. As stated in the Abstract, a voltage detecting portion 14 is used to detect a terminal voltage of a laser diode 11. A peak detecting portion 15 detects a peak value of output of the voltage detecting portion 14. A current control portion 16 controls a drive current of the laser diode 11 in accordance with an output of the peak detecting portion 15. In accordance with an output signal of an error detection portion 16b, the drive current of the laser diode 11 is

controlled. In this way, it is possible to stabilize light output of the laser diode 11 without using a photodiode for monitoring.

In order to support an obviousness rejection, the combination of the cited art must teach or suggest all of the elements of a claim. Returning to claim 1, neither *Shimada* or *Asano* disclose the operation of determining cavity losses according to a monitored voltage across a gain region. *Shimada* monitors a terminal voltage of semiconductor laser element 1 to extract the data stored on recording medium 7, wherein the terminal voltage changes in response to the self-coupling effect. *Asano* monitors the voltage across a laser diode to stabilize the light output of a laser diode without requiring the use of a photodiode for monitoring the light output. Furthermore, the stated objective of *Asano*'s invention is to provide a light emitting device drive circuit capable of stabilizing changes of light output of a light emitting device *due to temperature changes* (col. 2, lines 11-14, emphasis added). Since the claimed element of determining cavity losses according to a monitored voltage across a gain region is clearly not taught or suggested by either *Shimada* or *Asano*, alone or in combination, the rejection of claim 1 is improper, and should be withdrawn. Furthermore, each of claims 2-4, which depend directly or indirectly from claim 1, are also in condition for allowance for at least the same reasons.

With further respect to claim 2, this claim is roughly analogous to the apparatus of original claim 22, and comprises the method of claim 1 further including the operation of "adjusting a loss characteristic associated with said laser according to said monitored voltage across said gain medium." With regard to the rejection of claims 22 and 29, the Examiner asserts that *Asano* discloses a control system operatively coupled to the voltage sensor and to a loss element positioned in the optical path in the cavity, wherein the control system is configured to adjust the loss element according to the monitored voltage across the gain medium, referencing Figure 18 or *Asano* and Figure 6 of *Shimada*. Applicants respectfully assert this rejection is not supported.

First of all, *Shimada* does not adjust a loss characteristic associated with a laser, nor teach or suggest a mechanism for doing so. In fact, even if one were to consider spatially uneven phase plate 11 to be a loss element, there would be no benefit gained in adjusting it – its purpose is to generate the multi-mode laser beam, and it is not used for any other purpose. Furthermore, there would be no motivation to combine the control aspect of *Asano* with the apparatus of *Shimada*, as there is no need to control the current of the semiconductor laser element of *Shimada*, since this would change the sensed voltage across the laser element, and thus defeat the data extraction capability of the *Shimada* device. Accordingly, the rejection of claim 2 is improper and should be withdrawn.

With further respect to claim 3, neither *Shimada* or *Asano* teach or suggest the operation of adjusting a loss element associated with a laser to adjust a loss characteristic of a laser. With further respect to claim 4, neither *Shimada* or *Asano* teach or suggest positionally adjusting a loss element to adjust a lost characteristic of a laser. Accordingly, the rejection of claims 3 and 4 are improper, and should be withdrawn.

Traversal of the Rejection of Claim 5 and Claims Dependent Thereon

Claim 5 concerns a method for controlling performance of a laser cavity, wherein the method includes the operation of "determining optical losses associated with said laser cavity according to said monitored voltage across said gain medium." For similar reasons to those discussed above in traversal of the rejection of claim 1, applicants respectfully assert that the rejection of claim 5 is improper, and should be withdrawn. Each of claims 6-20, which either depend directly or indirectly from claim 5, are also in condition for allowance for at least the same reasons.

In addition, further operations recited in claims 6, 7, and 9 are analogous to similar operations recited in claims 2, 3, and 4, respectively. For similar reasons to

those discussed above with reference to claims 2-4, claims 6, 7 and 9 are patentable over the cited art.

With further respect to claim 8, this claim is roughly analogous with the apparatus claim of claim 23. The Examiner rejected claim 23 under 35 U.S.C. § 103(a) as being unpatentable over *Shimada* in view of *Asano*, further in view of *Van Dijk*. The Examiner asserts that *Van Dijk* discloses a dither element operatively coupled to a loss element and configured to introduce a frequency dither to said loss element, said frequency dither detectable in said monitored voltage across said gain medium, referencing column 14, lines 51-52.

Van Dijk discloses an optical resonator for a laser that includes an optical element mounted for rotation about two mutually transverse axes and controllable by a computer for automatically adjusting the orientation of the optical element. The cited text states:

> The pulse to pulse frequency variation of the MAL has been minimized by repositioning the third mirror using as a reference the absorption signals of ethylene described above. Other locking systems use heterodyne or *dither techniques*. These are only examples of feedback signals. (Col. 14, lines 47-52, emphasis added)

Van Dijk provide no more details of what dither techniques he is referring to, nor how they work. It is apparent from the paragraph beginning at col. 14, line 47 that the dither techniques are directed to a locking system to *lock the frequency of the multi-atmosphere laser* (MAL). Furthermore, the dither technique does not reference any elements in *Van Dijk*'s apparatus. Clearly, *Van Dijk* provides no teaching or suggestion of introducing a frequency dither to a loss element or deriving an error signal from a monitored voltage across a gain medium, wherein the error signal is indicative of propagation characteristics of the frequency modulation. Accordingly, the rejection of claim 8 is improper and should be withdrawn. Furthermore, there is no teaching or

suggestion that the frequency modulation is carried out in periodic bursts, as recited in claim 19. Accordingly, claim 19 is patentable over the cited art for this further reason.

With respect to claim 10, applicants respectfully assert that *Shimada* does not employ a loss element comprising an end mirror.

With further respect to claims 11-13 and 20, applicants respectfully assert that the claimed operations are not taught or suggested by the cited art. In particular, there is not teaching or suggestion of introducing a frequency modulation to a plurality of positional degrees of freedom of a loss element, deriving an error signal indicative of propagation characteristics or the frequency modulation to each of the plurality of positional degrees of freedom of the loss element, or adjusting the plurality of positional degrees of freedom. Accordingly, the rejection of claims 11-13 and 20 are improper and should be withdrawn.

With further respect to claims 14-18, the are no teachings or suggestions in the cited art pertaining to adjusting a plurality of loss elements associated with the laser cavity according to the monitored voltage of across the gain medium. Accordingly, the rejection of claims 14-18 are improper and should be withdrawn.

<u>Argument in Support of Allowance of Amended Apparatus Claim 21 and Claims Dependent Thereon</u>

Claim 21 has been amended to incorporate the subject matter of claim 22, as originally filed. Claim 21 now recites.

21. (Amended) A laser apparatus, comprising:

(a) a gain medium to emit a coherent beam along an optical path;

(b) a reflector positioned in said optical path and defining a laser cavity;

(c) a voltage sensor operatively coupled to said gain medium to monitor voltage across said gain medium; and

(d) a control system operatively coupled to said voltage sensor *and to a loss element positioned in said optical path in said cavity*, said control system *to adjust said*

loss element according to said monitored voltage across said gain medium to reduce optical losses associated with said cavity. (Emphasis added.)

Clearly, as discussed above, none of the prior art teaches or suggests controlling a loss element positioned in an optical path to reduce optical losses associated with a laser cavity. In addition, under *Shimada* a laser beam is reflected off of a recording medium to extract data stored thereon, and thus *Shimada* does not employ a reflector to define a laser cavity as would be understood by those skilled in the art. Accordingly, claim 21, as amended, is in condition for allowance. Furthermore, each of claims 23-26, which are dependent on claim 21, are patentable over the cited art for at least the same reasons.

With further respect to claim 23, this claim comprises an apparatus for performing the method of claim 8. For similar reasons to those presented above with respect to claim 8, the apparatus of claim 23 is further patentable over the cited art.

With further respect to claim 24, *Shimada* does not disclose a loss element comprising a reflector. Even if the recording medium was considered to be a reflector, it does not comprise a loss element. Accordingly, claim 25 is further patentable over the cited art.

With further respect to claim 25, none of the prior art references teach or suggest a laser apparatus employing a plurality of dither elements, each operatively coupled to a corresponding positional degree of freedom of a loss element and producing a frequency dither detectable in a monitored voltage across a gain medium. Accordingly, claim 25 is further patentable over the cited art.

With further respect to claim 26, the cited art does not teach or suggest a laser apparatus including a plurality of loss elements positioned in an optical path of a laser cavity and a control system operatively coupled to a voltage detector and each loss element, wherein the control system adjusts each loss element according to a

monitored voltage across the gain medium. Accordingly, claim 26 is further patentable over the cited art.

With further respect to claim 27, the cited art does not disclose a plurality of dither elements coupled to respective loss elements to introduce a frequency dither to each loss element. Accordingly, claim 27 is further patentable over the cited art.

<u>Traversal of the Rejection of Claim 28 and Claims Dependent Thereon</u>

Claim 28 recites a laser apparatus that is substantially analogous to the apparatus of claim 21, expect for the use of means for language in place of specific elements. Applicants respectfully assert that the prior art does not teach or suggest a laser apparatus employing a loss means positioned in association with the laser cavity to produce a loss characteristic or a means for determining the loss characteristic according to the voltage monitored across the gain medium means. Accordingly, the rejection of claim 28 is improper and should be withdrawn. Furthermore, each of claims 29 and 30, which depend from claim 28, are in condition for allowance for at least the same reasons as claim 28.

With further respect to claim 29, the cited art does not teach or suggest of a laser apparatus that includes a means for adjusting a loss element according to an error signal derived from the monitored voltage across the gain medium. Accordingly, claim 28 is further patentable over the cited art.

With further respect to claim 30, which has been amended to properly reference the claim from which it was to depend (claim 28), the prior art of record does not teach or suggest a laser apparatus that includes a dither means fro introducing a frequency modulation to a loss element. Accordingly, claim 30 is further patentable over the cited art.

CONCLUSION

Overall, none of the references singly or in any motivated combination disclose, teach, or suggest what is recited in the independent claims. Thus, given the above

amendments and accompanying remarks, independent claims 1, 5, 21, and 28 are now in condition for allowance. The dependent claims that depend directly or indirectly on these independent claims are likewise allowable based on at least the same reasons and based on the recitations contained in each dependent claim.

If the undersigned attorney has overlooked a teaching in any of the cited references that is relevant to the allowability of the claims, the Examiner is requested to specifically point out where such teaching may be found. Further, if there are any informalities or questions that can be addressed via telephone, the Examiner is encouraged to contact the undersigned attorney at (206) 292-8600.

Charge Deposit Account

Please charge our Deposit Account No. 02-2666 for any additional fee(s) that may be due in this matter, and please credit the same deposit account for any overpayment.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN

Date: Nov. 19, 2002

R Alan Burnett

R. Alan Burnett
Reg. No. 46,149

MARKED-UP VERSION OF THE AMENDED SPECIFICATION

Paragraph 0031:

Grid etalon 35 may be a parallel plate solid, liquid or gas spaced etalon, and may be tuned by precise dimensioning of the optical thickness between faces 38, 40 by thermal expansion and contraction via temperature control. The grid etalon 34 may alternatively be tuned by tilting to vary the optical thickness between faces 38, 40, or by application of an electric field to an electro-optic etalon material. Various other grid generating elements are know to those skilled in the art and may be used in place of grid etalon 34. Grid etalon 35 may be thermally controlled to prevent variation in the selected grid that may arise due to thermal fluctuation during operation of external cavity laser 10. Grid etalon 34 alternatively may be actively tuned during laser operation as described in the U.S. Patent Application Ser. No. 09/900,474 entitled "External Cavity Laser with Continuous Tuning of Grid Generator" to inventor Andrew Daiber, co-filed herewith, and incorporated herein by reference.

Paragraph 0034:

A wedge etalon channel selector 36 as shown in FIG. 1 is only one tunable element that may be used in accordance with the invention in an external cavity laser. Various other types of channel selector may be used in the invention. The use of an air gap wedge etalon for channel selection is described in U.S. Patent No. 6,108,355, wherein the "wedge" is a tapered air gap defined by adjacent substrates. The use of pivotally adjustable grating devices as channel selectors tuned by grating angle adjustment and the use of an electro-optic tunable channel selector in an external cavity laser and tuned by selective application of voltage are described in U.S. Patent Application Ser. No. 09/814,646 to inventor Andrew Daiber and filed on March 21, 2001. The use of a translationally tuned graded thin film interference filter as a channel selector is described in U.S. Patent application Ser. No. 09/814,646 and in U.S. Patent Application Ser. No. 09/900,412 entitled "Graded Thin Film Wedge Interference Filter

and Method of Use for Laser Tuning" to inventors Hopkins et al., co-filed herewith. The aforementioned disclosures are incorporated herein by reference.

Paragraph 0056:

The use of a thermally controlled tuning element to positionally adjust an end mirror and other optical components in an external cavity laser is also described in U. S. Patent Application Ser. No. 09/814,646 to inventor Andrew Diaber, filed on March 21, 2001, and in U.S. Patent Application Ser. No. <u>09/900,443</u> entitled "Laser Apparatus with Active Thermal Tuning of External Cavity" to inventors Mark Rice et al., which is co-filed simultaneously herewith. These disclosures are incorporated herein by reference. End mirror 14 may alternatively be tuned or adjusted by various other tuning mechanisms according to error signals derived from voltage measured across gain medium 12. For example, end mirror 14 may be tuned by a phase compensator or mechanically positioned by a stepper motor operating according to instruction from controller 76.

<u>MARKED-UP VERSION OF THE AMENDED CLAIMS</u>

21. A laser apparatus, comprising:

(a) a gain medium [emitting] <u>to emit</u> a coherent beam along an optical path;

(b) a reflector positioned in said optical path and defining a laser cavity; [and]

(c) a voltage sensor operatively coupled to said gain medium [and configured] to monitor voltage across said gain medium[, said monitored voltage across said gain medium indicative of optical losses associated with said cavity]; <u>and</u>

<u>(d) a control system operatively coupled to said voltage sensor and to a loss element positioned in said optical path in said cavity, said control system to adjust said loss element according to said monitored voltage across said gain medium to reduce optical losses associated with said cavity</u>.

30. The laser apparatus of claim [26] <u>28</u>, further comprising dither means for introducing a frequency modulation to said loss element.